Synthetic Division

- finding the solution without the hard work

eg. $x^3 + 3x^2 - 2x + 4 \quad \div x + 1$ ①

method only works when dividing by $x+a$ (coefficient of $x = 1$)

② layout

	$1x^3$	$3x^2$	$-2x$	4
$x+1$	⊙			

③ add divisor

④ write down coefficients of the dividend

⑤ add zero under first coefficient

	1	3	−2	4
$x+1$	0	1		
	(1)			

⑥ (1 − 0) find remainder

⑦ multiply remainder by $+a$, write it under next coefficient

⑧

	1	3	−2	4
$x+1$	0	1	2	
	1	(2)		

(3 − 1) find remainder

⑨ multiply remainder by $+a$, write it under next coefficient

⑩

	1	3	−2	4
$x+1$	0	1	2	−4
	1	2	(−4)	

(−2 − 2) find remainder

⑪ multiply remainder by $+a$, write it under next coefficient

(12)

$x+1$	1	3	−2	4
	0	1	2	−4
	1	2	−4	8

$(4-{}^{-}4)$

(14) now use the remainders as coefficients for x^2, x & constant & remainder (if any, over divisor)

eg $1x^2 + 2x - 4 \quad +\frac{8}{x+1}$

Ex2 $x^3 + 2x^2 - 5x + 2 \div (x) - 1$

OK to go!

$x-1$	1	2	−5	2
	0	−1	−3	2
	1	3	−2	0

$(1-0)$ $(2-1\times{}^{-}1)$ $(-5-3\times{}^{-}1)$ $(2-{}^{-}2\times{}^{-}1)$

$= x^2 + 3x - 2$ so $(x-1)$ is a factor (x^2+3x-2)

$= x^3 + 2x^2 - 5x + 2$.

Ex3 $2x^3 + 5x^2 - 4x - 5 \div (2x+1)$

STOP!! $= 2(x+\frac{1}{2})$ use this

$x+\frac{1}{2}$	2	5	−4	−5
	0	1	2	−3
	2	4	−6	−2

$(2-0)$ $(5-2\times\frac{1}{2})$ $(-4-4\times\frac{1}{2})$ $(-5-{}^{-}6\times\frac{1}{2})$

$= 2x^2 + 4x - 6 - \frac{2}{x+\frac{1}{2}}$

so $\left(x+\frac{1}{2}\right)\left(2x^2+4x-6-\frac{2}{x+\frac{1}{2}}\right)$

we need this to be $2(x+\frac{1}{2})$ so take 2 out as a common factor from this bracket

$\left(x+\frac{1}{2}\right) \times 2\left(x^2+2x-3-\frac{2}{2(x+\frac{1}{2})}\right)$

$(2x+1)\left(x^2+2x-3-\frac{2}{2x+1}\right)$